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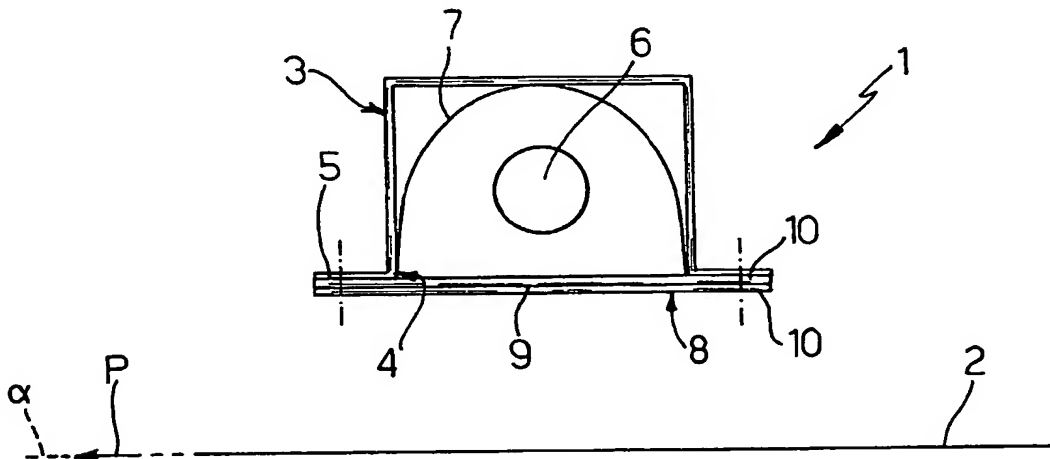
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(54) Title: DEVICE FOR TREATING A PACKAGING MATERIAL BY MEANS OF UV RADIATION



(57) Abstract: A device (1) for treating a packaging material (2) by means of UV radiation, the device having a source (6) of such radiation, and a protective screen (8) interposed between the source (6) and the material (2) for treatment; the screen (8) has a film (9) of a polymer resistant and permeable to UV radiation, and which is flexible, does not tear, and does not form fragments.

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DEVICE FOR TREATING A PACKAGING MATERIAL BY MEANS OF UV
RADIATION

5 TECHNICAL FIELD

The present invention relates to a device for treating a packaging material by means of UV radiation.

UV radiation has long been used in a wide range of applications. In the food industry, for example, it is
10 commonly used for disinfecting or sterilizing packaging material, or for surface treating the food products themselves.

UV radiation is also used for disinfecting work environments.

15 The device according to the present invention may conveniently be used, though not exclusively, in a packaging material sterilizing unit of a pourable food product packaging machine, to which application reference is made in the following description purely by
20 way of a non-limiting example.

BACKGROUND ART

Various types of machines are known for packaging various types of pourable food products, such as fruit juice, wine, tomato sauce, pasteurized or long-storage
25 (UHT) milk, etc.

Such machines have different characteristics, depending on the type of package used, e.g. packages

made of strip or sheet material, cups, bottles, tubs, etc.

One of the best-known packaging machines is the one marketed under the registered trademark Tetra Brik® -
5 referred to purely by way of a non-limiting example - in which the packages or packs are formed from a continuous tube of packaging material defined by a longitudinally sealed web.

The packaging material has a multilayer structure
10 comprising a layer of paper material covered on both sides with layers of heat-seal material, e.g. polyethylene. In the case of aseptic packages for long-storage products, such as UHT milk, the packaging material comprises a layer of barrier material, e.g.
15 aluminium foil, which is superimposed on a layer of heat-seal plastic material, and is in turn covered with another layer of heat-seal plastic material eventually defining the inner face of the package and therefore contacting the food product.

20 To produce aseptic packages, the web of packaging material is unwound off a reel and fed through a sterilizing unit, in which it is sterilized, for example, by immersion in a bath of liquid sterilizing agent, such as a concentrated solution of hydrogen
25 peroxide and water.

Alternatively, or in addition to being treated with

a liquid sterilizing agent, the web of packaging material may be treated by exposure to one or more sources of UV electromagnetic radiation, as described, for example, in European Patent Application EP-A-919246.

5 Downstream from the sterilizing unit, the web of packaging material is maintained in an aseptic chamber, in which it is dried, folded into a cylinder, and sealed longitudinally to form a continuous vertical tube. In other words, the tube of packaging material forms an
10 extension of the aseptic chamber, is filled continuously with the pourable food product, and is then fed to a forming and (transverse) sealing unit for producing the individual packages, and in which the tube is gripped between pairs of jaws and sealed transversely to form
15 aseptic pillow packs.

The pillow packs are separated by cutting the sealed portions in between, and are then fed to a final folding station where they are folded mechanically into the finished form.

20 Packaging machines of the type described above are used widely and satisfactorily in a wide range of food industries for producing aseptic packages from strip packaging material. Performance of the sterilizing unit, in particular, amply ensures conformance with
25 regulations governing the sterility of the packages.

Within the industry, however, a demand exists for

further improvement, particularly as regards the safety of UV devices, which may be used for both disinfecting and sterilizing various types of packaging material, such as strip and sheet material, cups, bottles, tubs, etc.

UV devices substantially comprise a UV radiation source housed in a casing and protected at the front by a screen made of material resistant and permeable to UV radiation. In commonly marketed devices, the screen is defined by a quartz plate.

Though perfectly suitable in terms of physical-chemical properties, quartz has various drawbacks. In particular, it is extremely expensive. Moreover, a quartz screen is fragile and, if broken, tends to form extremely hard, sharp fragments. In known machines, the UV device, and therefore the quartz screen, is so located as to be protected against impact, so that the risk of it breaking and leaving trace fragments of quartz on the packaging material is highly unlikely. Nevertheless, at present, the possibility cannot be entirely excluded. Though unlikely, breakage may be caused by anomalous vibration or thermal stress, by flaws in the structure of the material, by accidental forcing or impact during assembly, or by a combination of any of these.

Another drawback of quartz in this type of

application is its tendency to dirty easily in normal operating conditions, and where it is extremely difficult, expensive, or even impossible to clean, whereas replacement is far from cheap.

5 Quartz also has the further drawback of any flaws, cracks, dirt, etc. locally affecting its optical properties, thus possibly resulting in uneven irradiation of the material being treated.

DISCLOSURE OF INVENTION

10 It is an object of the present invention to provide a device for UV irradiation treatment of a packaging material, designed to eliminate the aforementioned hazards typically associated with known devices.

According to the present invention, there is
15 provided a device for treating a packaging material by means of UV radiation, the device comprising a source of said radiation, and a screen for protecting said source and which is interposed between the source and the material for treatment; characterized in that said
20 screen comprises a film of a polymer resistant and permeable to said UV radiation.

Using a film of a polymer resistant and permeable to UV radiation provides for meeting the requirements of chemical/physical compatibility with the workplace, and
25 at the same time for eliminating the drawbacks typically associated with quartz plates.

In particular, the flexibility of the polymer

material substantially eliminates any risk of tearing caused by vibration or thermal stress. And, even in the highly unlikely event of the film tearing, no fragments are formed, thus making the material perfectly suitable
5 for use in the food industry.

Moreover, a film of polymer material is much cheaper than a quartz plate, and can therefore be replaced quickly and cheaply in the event of soiling.

Finally, in the event of flaws in the structure,
10 i.e. on the surface, of the polymer film, uniform irradiation of the material being treated is unaffected, the polymer film being by nature slightly translucent and therefore still capable of ensuring adequate UV radiation diffusion.

15 In a preferred embodiment of the present invention, the polymer is fluorinated or, better still, completely fluorinated and in the perfluoroalkoxy (PFA) class.

More preferably, the fluorinated polymer is an MFA, the characteristics of which are particularly favourable
20 in terms of UV radiation transmission, even, for example, in the case of UV radiation with a 222nm wavelength, as described in the aforementioned European Patent Application EP-A-919246.

In one possible embodiment of the invention, the
25 polymer film is supported between substantially rigid grilles.

BRIEF DESCRIPTION OF THE DRAWINGS

A preferred, non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a section of a device for treating
5 packaging material in accordance with the invention;

Figure 2 shows a partly exploded view in perspective of the Figure 1 device:

BEST MODE FOR CARRYING OUT THE INVENTION

Number 1 in the accompanying drawings indicates as
10 a whole a device for treating a packaging material 2 for producing packages of a pourable food product.

By way of a non-limiting example, the packaging material is a sheet material.

Material 2 is fed continuously in known manner
15 along a path P in a plane α of the material.

Material 2 may be defined by a different type of material, such as a tub, cup, bottle, etc.

Device 1 extends crosswise to material 2, i.e. perpendicularly to path P and parallel to plane α , and
20 comprises an elongated outer casing 3 open on the side facing material 2 so as to form a window 4 defined by a peripheral flange 5. Device 1 also comprises a UV radiation source 6 housed longitudinally in casing 3, which is provided in conventional manner with a lining 7
25 of reflecting material.

Source 6 emits UV radiation of a wavelength, for example, of 222 nm.

The device also comprises a protective screen 8 fixed at the front to flange 5 so as to close window 4.

According to the present invention, screen 8 comprises a film 9 of a polymer material resistant and permeable to the UV radiation emitted by source 6.

The polymer material may be of any type, providing it is transparent to UV radiation ($T \geq 80\%$) and resistant to said UV radiation in the operating conditions and for the time period between two successive replacements.

The polymer material may, for example, be in the polyolefin group, such as PE or PP.

Depending on the different resistance to UV radiation of different possible types of polymer film, provision may be made for appropriate, programmed, periodic replacement of film 9 of polymer material, so as to ensure constant mechanical and optical properties of the film.

Replacement may be made, for example, either at given times, or continuously, using a strip of polymer material moving continuously between two appropriately powered reels.

In a preferred embodiment, the material is a fluorinated polymer, or a completely fluorinated polymer in the perfluoroalkoxy (PFA) class, and even more preferably is an MFA, e.g. the MFA produced by AUSIMONT® under the trade name HYFLON® MFA.

Film 9 is conveniently 20 to 200 μm thick, is preferably 40 μm , 50 μm , or 100 μm thick, and is in the form of a flexible, slightly translucent film capable of diffuse transmission of a fraction of the incident radiation.

Though film 9, by virtue of its physical characteristics, may be used alone and simply fixed along the edges to flange 5, it is preferably interposed between two substantially rigid metal supporting grilles 10, which are fixed to flange 5 by means of respective peripheral frames 11, and provide for protecting and keeping the film flat.

Film 9 has excellent characteristics in terms of transmittance and resistance to ageing under UV radiation, as shown in the following examples.

EXAMPLE 1

A 50 μm thick film of Hyflon[®] MFA was exposed to 300KJ/cm² UV radiation of 222 nm wavelength for 800 hours. After exposure, the film showed no visible alteration, and 90% transmittance referred to the above 222 nm wavelength.

EXAMPLE 2

A 100 μm thick film of Hyflon[®] MFA was exposed to 300KJ/cm² UV radiation of 222 nm wavelength for 800 hours. After exposure, the film showed no visible alteration, and 82% transmittance referred to the above

222 nm wavelength.

Film 9 does not tear in the event of anomalous thermal stress or vibration, and, even if torn by accidental impact, which is substantially impossible in
5 working conditions, does not produce fragments.

Film 9 is also much cheaper than a conventional quartz plate.

Clearly, changes may be made to the present invention without, however, departing from scope of the
10 invention itself.

In particular, the screen may be made of a different polymer material, e.g. PE, PP, PFA or many others.

Also, grilles 10 may be different or even dispensed
15 with.

CLAIMS

1) A device for treating a packaging material (2) by means of UV radiation, the device comprising a source (6) of said radiation, and a screen (8) for protecting said source (6) and which is interposed between the source (6) and the material (2) for treatment; characterized in that said screen (8) comprises a film of a polymer resistant and permeable to said UV radiation.

2) A device as claimed in Claim 1, characterized in that said polymer is fluorinated.

3) A device as claimed in Claim 1, characterized in that said polymer is completely fluorinated.

4) A device as claimed in Claim 3, characterized in that said polymer is in the perfluoroalkoxy (PFA) class.

5) A device as claimed in Claim 4, characterized in that said polymer is an MFA.

6) A device as claimed in any one of the foregoing Claims, characterized in that said film (9) is of a thickness ranging between 20 and 200 μm .

7) A device as claimed in Claim 6, characterized in that the thickness of said film is selected between 40 μm or 100 μm .

8) A device as claimed in any one of the foregoing Claims, characterized in that said screen (8) comprises

a pair of substantially rigid grilles (10) between which said film (9) is supported.

INTERNATIONAL SEARCH REPORT

International Application No

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A. CLASSIFICATION OF SUBJECT MATTER
 IPC 7 B65B55/08 A61L2/10

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
 IPC 7 B65B A61L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 580 176 A (IMAB STIFTUNG) 26 January 1994 (1994-01-26) column 3, line 11 - line 49; claim 9; figures	1-3
A	EP 1 074 186 A (HERAEUS NOBLELIGHT GMBH) 7 February 2001 (2001-02-07) column 4, line 51 - column 5, line 37; figures	1
A	US 6 202 384 B1 (KURTH GUNTER ET AL) 20 March 2001 (2001-03-20) column 3, line 13 - column 4, line 52; figures	1
A	US 5 433 920 A (SIZER CHARLES E ET AL) 18 July 1995 (1995-07-18)	
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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INTERNATIONAL SEARCH REPORT

International Application No.

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C.(Continuation) DOCUMENTS CONSIDERED RELEVANT		
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 446 289 A (SHODEEN KEITH ET AL) 29 August 1995 (1995-08-29) -----	
A	EP 0 424 153 A (DU PONT) 24 April 1991 (1991-04-24) -----	

INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 03/02471

Patent document cited in search report		Publication date		Patent family member(s)	Publication date
EP 0580176	A	26-01-1994	DE	4224308 A1	27-01-1994
			EP	0580176 A1	26-01-1994
EP 1074186	A	07-02-2001	DE	19935379 A1	08-02-2001
			CN	1287810 A	21-03-2001
			EP	1074186 A2	07-02-2001
			JP	2001097319 A	10-04-2001
US 6202384	B1	20-03-2001	DE	19903259 C1	13-07-2000
			EP	1024086 A2	02-08-2000
US 5433920	A	18-07-1995	US	5326542 A	05-07-1994
			AT	160741 T	15-12-1997
			AU	665275 B2	21-12-1995
			AU	4874293 A	14-04-1994
			CA	2107033 A1	02-04-1994
			CZ	9302053 A3	13-04-1994
			DE	69315527 D1	15-01-1998
			DE	69315527 T2	02-04-1998
			DK	591001 T3	10-08-1998
			EP	0591001 A1	06-04-1994
			ES	2112399 T3	01-04-1998
			FI	934280 A	02-04-1994
			JP	2889094 B2	10-05-1999
			JP	6261720 A	20-09-1994
			NO	933504 A	05-04-1994
			RU	2118173 C1	27-08-1998
US 5446289	A	29-08-1995	AT	211926 T	15-02-2002
			CA	2187877 A1	26-10-1995
			DE	69525047 D1	21-02-2002
			DE	69525047 T2	14-11-2002
			DK	755271 T3	18-03-2002
			EP	0755271 A1	29-01-1997
			WO	9528181 A1	26-10-1995
EP 0424153	A	24-04-1991	US	5254608 A	19-10-1993
			CA	2027874 A1	20-04-1991
			DE	69024596 D1	15-02-1996
			DE	69024596 T2	22-08-1996
			EP	0424153 A2	24-04-1991
			JP	3192143 A	22-08-1991